DOCUMENT RESUME

ED 298 073 SO 019 556

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TITLE Science/Technology/Society in the Social Studies. ERIC Digest.

INSTITUTION ERIC Clearinghouse for Social Studies/Social Science Education, Bloomington, IN.
SPONS AGENCY Office of Educational Research and Improvement (ED), Washington, DC.
REPORT NO EDO-SO-88-8
PUB DATE Sep 88
CONTRACT RI88062009
NOTE 4p.
AVAILABLE FROM ERIC Clearinghouse for Social Studies/Social Science Education, 2805 East Tenth Street, Suite 120, Indiana University, Bloomington, IN 47405.
PUB TYPE Information Analyses - ERIC Information Analysis Products (071)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS *Citizenship Education; Civics; Critical Thinking; Curriculum Enrichment; Elementary Secondary Education; *Public Affairs Education; *Science and Society; *Social Studies; Technological Literacy
IDENTIFIERS ERIC Digests

ABSTRACT

The current trend to include the relationships of science and technology to human societies in the social studies curriculum is the focus of this ERIC Digest. The Digest discusses: (1) major themes in education on science/technology/society (STS); (2) the rationale for emphasizing STS in the social studies; and (3) how to include STS in the curriculum. The major themes of STS suggest the compatability of STS with social studies and include worldwide issues such as nuclear power, genetic engineering, and unchecked population growth. Critical thinking skills for making rational decisions about these issues are described as are participation skills in civic action projects. The rationale for the inclusion of STS in the curriculum stresses the need to develop capabilities of synthesizing and applying knowledge from many academic disciplines. STS can be incorporated into the social studies curriculum by infusion into an existing history, geography, or civics course, extending an existing unit of study to include an activity based on a STS issue, or creating a separate course of study that focuses on current social problems and issues. A 10-item reference and ERIC resources list is included. (DJC)

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BY

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ERIC Digest EDO-SO-88-8

September 1988

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ERIC Digest EDO-SO-88-8 September 1988

SCIENCE/TECHNOLOGY/SOCIETY IN THE SOCIAL STUDIES

by Phillip A. Heath

A current trend in social studies education is concern about the relationships of science and technology to human societies in the past and present. The National Council for the Social Studies and the Social Science Education Consortium, for example, have sponsored activities and publications to bring about improvement in teaching and learning about science and technology as powerful shapers of our modern world. Other advocates of education about science and technology in society include the National Science Teachers Association, Carnegie Foundation for the Advancement of Teaching, American Association for the Advancement of Science, and the National Endowment for the Humanities. Given the advocacy of national leaders, there appears to be a movement to infuse science- and technology-related topics and issues into the curricula of elementary and secondary schools. There is little evidence, however, of widespread classroom adoption of content about science/technology/society (STS).

Current efforts to promote science/technology/society in elementary and secondary schools will not succeed unless educators know what education on STS is, why it is an important part of education in the social studies, and how to include it in the curriculum. This ERIC Digest focuses on (1) major themes in education on STS, (2) the rationale for emphasizing STS in the social studies, and (3) how to include STS in the curriculum.

What Are Some Major Themes of STS in Social Studies Education? Education on STS involves, first of all, consideration of the various interactions of science and technology in a social context. Science and technology affect and are affected by the institutions and values of a society. The following examples of major STS themes suggest the compatibility of teaching and learning about science/technology/society with education in the social studies.

1. Critical Public Issues that affect the Well-Being of Individuals and Societies Throughout the World. Societies of our modern world are increasingly propelled and changed by advances in science and technology, which generate critical public issues. These issues pertain to such matters as the technical efficiency and public safety of nuclear power plants, the hazards of recombinant DNA research and genetic engineering, and the perils posed by modern weapons. A study by Bybee and Mau (1986) indicates that science educators perceive the most important STS problem in our world to be world-wide hunger, unchecked population growth, declining air quality, depletion of water resources, and the destructive capacity of modern weapons systems.

2. Processes and Skills in Thinking about Critical Public Issues Associated with Science and Technology. Education about STS issues involves development of higher-order cognitive abilities associated with processes of decision making, problem solving, and critical thinking. Students who confront science- and technology-related social issues have opportunities to inquire about alternatives and their consequences in the process of making rational and defensible choices.

3. The Utility of Trade-offs in Decision Making on STS Issues. Public issues anchored in scientific and technological applications to society often involve trade-offs between conflicting values in which there is no clear view of right or wrong. Many environmental issues, for example, may involve a compromise or trade-off among conflicting value positions (e.g., limiting pollution sufficiently to protect health and environment while still maintaining a satisfactory level of production and employment.) Students are required to think in terms of *more or less* of one thing or another instead of making an uncompromising choice of *either* one thing *or* another.

4. Knowledge and Skills in Civic Action. The emphasis here is on an individual's capability and willingness to participate in civic decision making about STS issues and to act upon these decisions. Opportunities are provided for testing proposed actions through civic participation. While simulations and role-play activities are included in most STS units of instruction, there is also need for civic action projects that are consistent with school-district rules and regulations.

5. Interrelationship and Integration of Knowledge and Cognitive Process Skills from Several Academic Disciplines. STS issues cut across disciplinary boundaries, such as biology, geology, geography, history, and political science. Students and teachers are required to flexibly apply content from various subjects to inquire about issues and make warranted choices in responses to them.

What Is the Rationale for Including Content on STS in the Social Studies Curriculum? The argument for emphasizing STS in the social studies curriculum is based on a primary goal of American elementary and secondary schools—education for responsible citizenship in a constitutional democracy. In order to properly address this goal in today's world, educators must emphasize the pervasive, powerful effects of science and technology in society. Citizens of a modern constitutional democracy can neither perceive current events and issues accurately, nor think clearly about them, nor act responsibly and effectively on them unless they know about science and technology as powerful cultural forces that have shaped these critical events and issues. This kind of general education for citizenship is likely to help students from all social groups understand more fully their own civilization and its connections to the world and to participate more responsibly in the democratic process.

Common memory—widespread knowledge of the heritage of a society—is an important aspect of citizenship, to which education on STS makes a solid contribution. Scientific and technological advances are an integral part of the heritage of citizens of the

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United States, and they will continue to shape the development of our world. Considering that an understanding of this heritage is a critical component of citizenship education, the social studies curriculum of elementary and secondary schools should include a historical to present-day perspective on relationships of scientific and technological effects to the development of society.

The ability of citizens to make informed, rational decisions is a fundamental goal of American education, which is directly linked to understanding of public issues related to societal applications of science and technology. If the social studies curriculum includes an emphasis on the interactions of science, technology, and society, and the decisions that citizens make in their social and personal lives in terms of these interactions, then students are likely to develop capabilities that enable them to act responsibly and effectively as members of local, national, and global communities.

Ability to connect information and ideas within and between academic disciplines and to link different fields of knowledge is a key to high-level understanding of social reality. Education for responsible and competent citizenship in an increasingly complex technological society requires that students be able to synthesize and apply knowledge from many disciplines. Every discipline in the social studies can be basically connected to content on science and technology in society. To ignore this reality will limit students' abilities to comprehend their world and to act effectively within it. Thus, content on STS must be connected to the study of geography, economics, political science, history, and other subjects in the social studies curriculum to help students make connections among facts and ideas needed for responsible citizenship in today's world. Furthermore, content on STS in the social studies curriculum can and should be connected to education on science/technology/society in the science curriculum.

What Can Be Done to Infuse STS into the Social Studies Curriculum? Attempts to "place" or infuse STS into the curriculum can be considered in terms of three categories:

- Infusion into existing courses of study.
- Extension of an existing unit of study.
- Creation of a separate course of study.

1. Infusion into Existing Courses of Study. Using this approach, teachers systematically and pervasively add content on STS to a course on history, geography, or civics, for example. One advantage of this approach is that STS content, and materials and teaching methods associated with it, become part of the standard curriculum; therefore they are more likely to be accepted as an ongoing part of the school's mission. The disadvantage, and difficulty, is deciding what to omit from standard courses to make room for addition of STS content.

2. Extension of an Existing Unit of Study. This approach calls for adding STS content and activities to the end of a lesson or set of lessons on traditional content in the social studies. For example, a civics unit on interest groups might include a case study of interest group activity about an environmental issue that involves STS content. Students might be required to make and defend civic decisions in response to this STS issue that is appended to standard course content. The main advantage of this approach is maximum flexibility in deciding how much and when to variously treat STS content. A main disadvantage is the likelihood of superficial and unsystematic treatment of STS content.

3. Creation of a Separate Course of Study. A few schools have developed and implemented separate courses on STS. These courses, which are in most cases electives for high school students, tend to be interdisciplinary or multidisciplinary in content, drawing upon subject matter from history and the various social and natural sciences. Course content usually is organized around current social problems and issues. One advantage of separate STS courses is to give high visibility and legitimacy to this emerging field of study. Another advantage is to provide ample opportunity for systematic and sustained study of the various interrelationships of science/technology/society. A disadvantage is the great complexity of the challenge of organizing course content that is drawn from various academic disciplines.

Proposals for infusion of instruction dealing with science- and technology-related social issues have been met with predictable concerns about an overcrowded curriculum, the shortage of materials, and the need for teacher education to overcome presumed deficiencies in knowledge and skills of classroom instructors. However, over and above these concerns is a general consensus among national leaders in education about the importance of science/technology/society in the general education of citizens for a democratic society.

A new curriculum framework report has been published by the Social Science Education Consortium for educators in the social studies and sciences who are willing to act on their assumptions about the importance of STS in citizenship education. Authored by Faith Hichman, John Patrick, and Rodger Bybee (1987), this publication provides guidelines for development and implementation of education on STS in secondary schools. The recommendations in this report (developed as part of an STS project funded by the National Science Foundation) provide a foundation for future work by science and social studies educators.

References and ERIC Resources

Following is a list of resources including references used to prepare this Digest. Those items followed by an ED number are in the ERIC system and are available in microfiche and/or paper copies from the ERIC Document Reproduction Service (EDRS). For information about prices, write EDRS, 1900 Wheeler Avenue, Alexandria, VA 22304 or call 1-800-227-3742. Entries followed by an EJ number are annotated monthly in CIJE *(Current Index to Journals in Education)* which is available in most libraries. EJ documents are not available through EDRS; however, they can be located in the journal section of most libraries by using the bibliographic information provided below.

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This publication was prepared with funding from the Office of Educational Research and Improvement, U.S. Department of Education, under contract no. RI88062009. The opinions expressed do not necessarily reflect the positions or policies of OERI or ED.